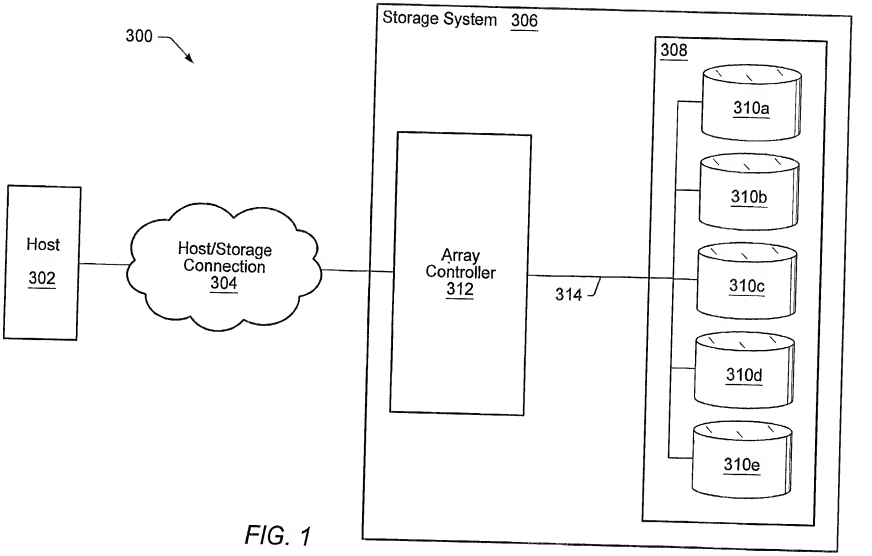
300
Storage System 306
308
310a
310b
310c
310d
310e
Host
302
Host/Storage
Connection
304
Array
Controller
312
314

FIG. 1

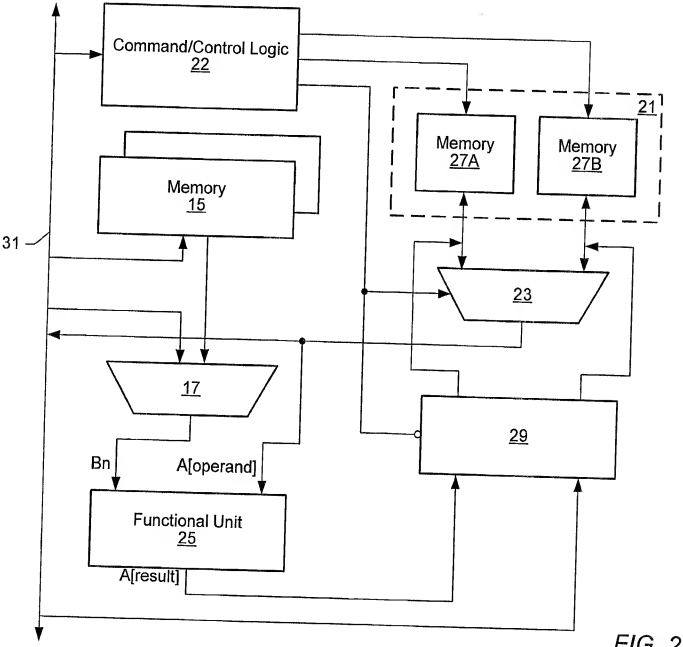
Command/Control Logic
22
21
Memory
27A
Memory
27B
Memory
15
31
23
17
29
Bn
A[operand]
Functional Unit
25
A[result]

FIG. 2

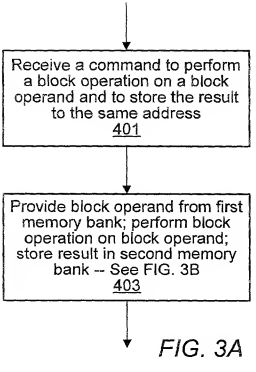

FIG. 3A

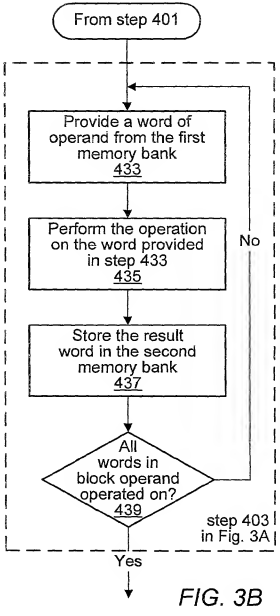

FIG. 3B

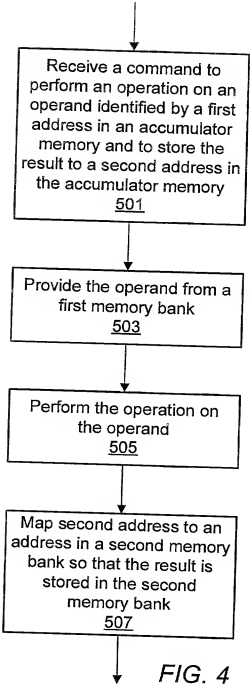

FIG. 4

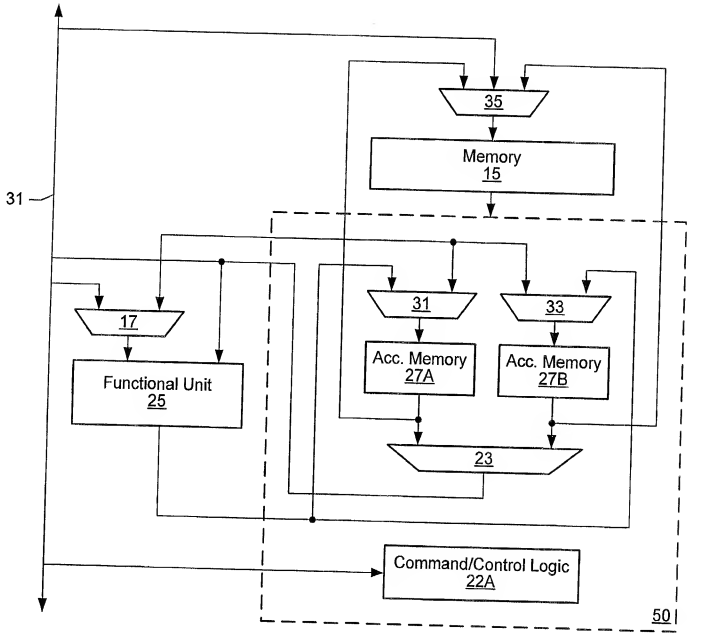

FIG. 5

Instructions	Acc. Memory 27A	Acc. Memory 27B	Memory 15
B = B0	B(new)	n/a	B0
B = B XOR B1	B(old)	B(new)	B1
B = B XOR B2	B(new)	B(old)	B2
B = B XOR B3	B(old)	B(new)	B3
B = B XOR B4	B(new)	B(old)	B4
flush cache	n/a	n/a	B

FIG. 6

Instructions	Acc. Memory 27A	Acc. Memory 27B	Memory 15
B = immed(B0)	B(new)	n/a	n/a
B = B XOR immed(B1)	B(old)	B(new)	n/a
B = B XOR immed(B2)	B(new)	B(old)	n/a
B = B XOR immed(B3)	B(old)	B(new)	n/a
B = B XOR immed(B4)	B(new)	B(old)	n/a
flush cache	n/a	n/a	B

FIG. 7

Accumulation Operations:

B = B0 XOR B1 XOR B2 XOR B3 XOR B4
C = C0 XOR C1 XOR C2 XOR C3 XOR C4
D = D0 XOR D1 XOR D2 XOR D3 XOR D4

Instructions:

(1) B = B0
(2) B = B XOR B1
(3) B = B XOR B2
(4) C = C0
(5) C = C XOR C1
(6) C = C XOR C2
(7) B = B XOR B3
(8) D = D0
(9) D = D XOR D1
(10) D = D XOR D2
(11) C = C XOR C3
(12) D = D XOR D3
(13) B = B XOR B4
(14) C = C XOR C4
(15) D = D XOR D4

FIG. 8A

Row#	Instructions/Operations	Acc. Memory 27A	Acc. Memory 27B	Memory 15
1	(1) B = B0	B(new)	n/a	B0
2	(2) B = B XOR B1	B(old)	B(new)	B1
3	(3) B = B XOR B2	B(new)	B(old)	B2
4	(4) C = C0	C(new)	n/a	C0
5	(5) C = C XOR C1	C(old)	C(new)	C1
6	(6) C = C XOR C2	C(new)	C(old)	C2
7	(7) B = B XOR B3	B(old)	B(new)	B3
8	(8) D = D0	n/a	n/a	n/a
9	(8) flush C	C	n/a	C
10	(8) load D	D(new)	n/a	D0
11	(9) D = D XOR D1	D(old)	D(new)	D1
12	(10) D = D XOR D2	D(new)	D(old)	D2
13	(11) C = C XOR C3	n/a	n/a	n/a
14	(11) flush B	n/a	B	B
15	(11) load C	n/a	C(new)	C
16	(11 completes)	C(new)	C(old)	C3
17	(12) D = D XOR D3	D(old)	D(new)	D3
18	(13) B = B XOR B4	n/a	n/a	n/a
19	(13) flush C	C	n/a	C
20	(13) load B	B(new)	n/a	B
21	(13 completes)	B(old)	B(new)	B4
22	flush B	n/a	B	B
23	(14) C = C XOR C4	n/a	n/a	n/a
24	(14) load C	n/a	C(new)	C
25	(14 completes)	C(new)	C(old)	C4
26	flush C	C	n/a	C
27	(15) D = D XOR D4	D(new)	D(old)	D4
28	flush cache	D	n/a	D

FIG. 8B

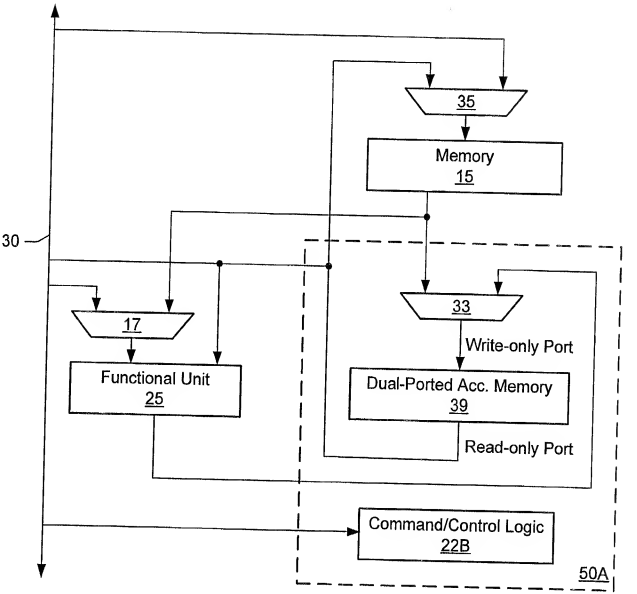
35
Memory
15
30
17
Functional Unit
25
33
Write-only Port
Dual-Ported Acc. Memory
39
Read-only Port
Command/Control Logic
22B
50A

FIG. 9

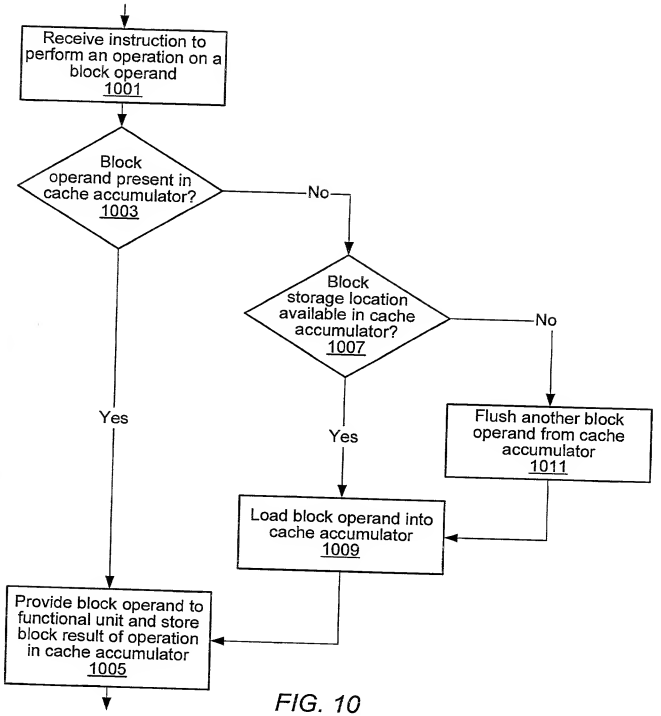
Receive instruction to perform an operation on a block operand
1001
Block operand present in cache accumulator?
1003
No
Yes
Block storage location available in cache accumulator?
1007
No
Yes
Flush another block operand from cache accumulator
1011
Load block operand into cache accumulator
1009
Provide block operand to functional unit and store block result of operation in cache accumulator
1005

FIG. 10

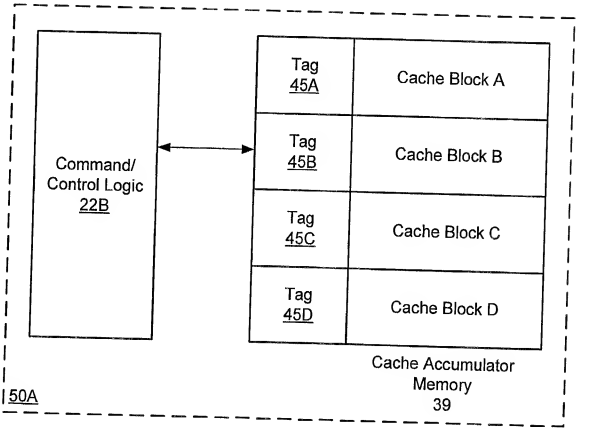

FIG. 11A

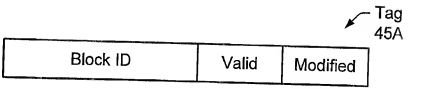

FIG. 11B

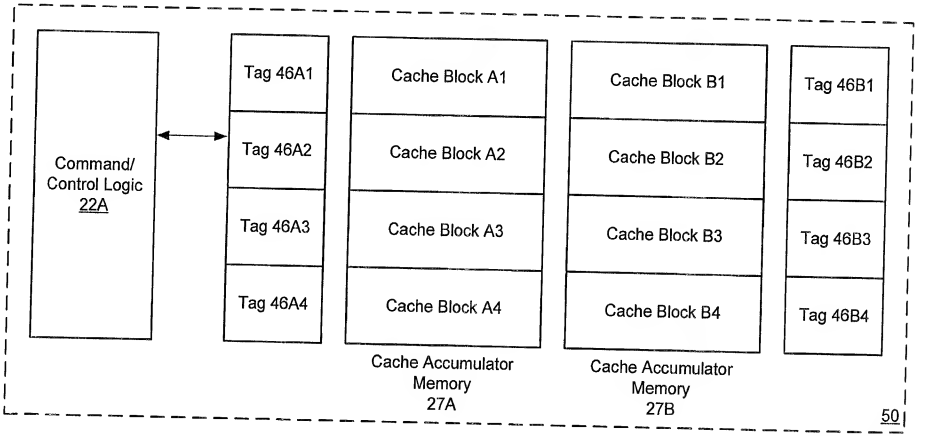

FIG. 12A

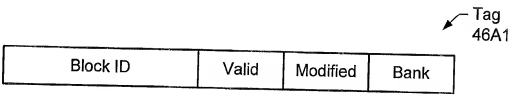

FIG. 12B

Accumulation Operation:
D = A XOR B XOR C

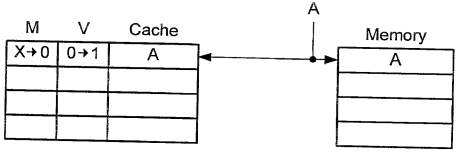

FIG. 13A

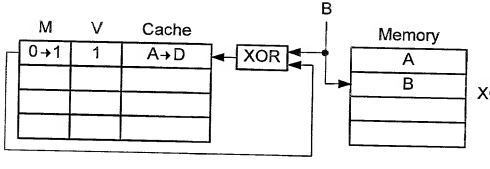

FIG. 13B

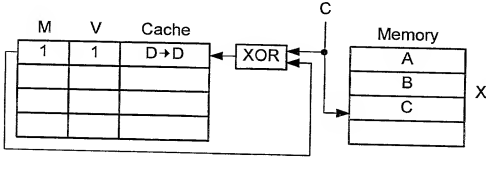

FIG. 13C

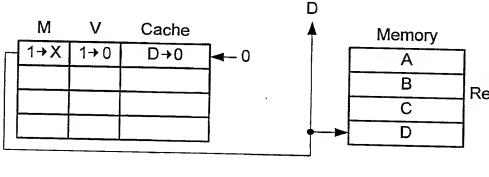

FIG. 13D

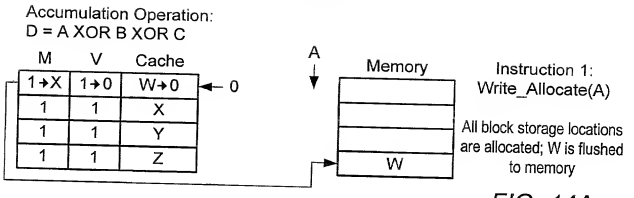

FIG. 14A

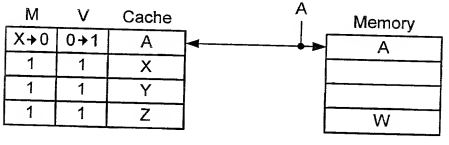

FIG. 14B

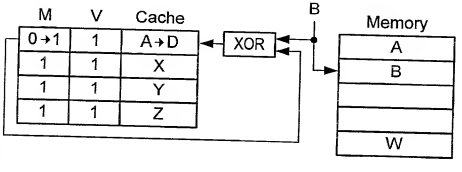

FIG. 14C

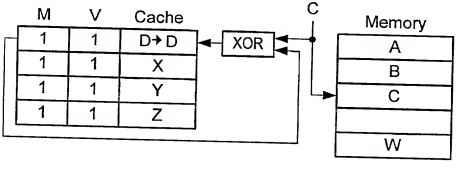

FIG. 14D

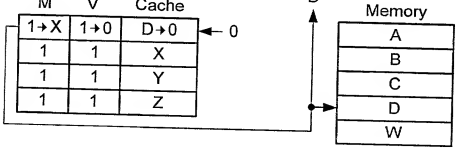

FIG. 14E

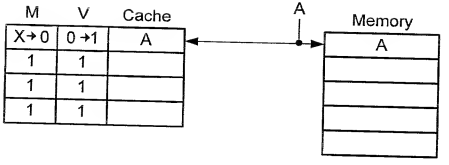

FIG. 15A

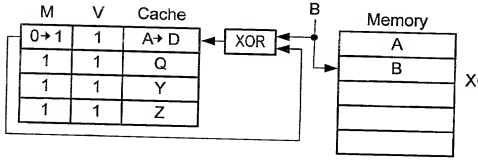

FIG. 15B

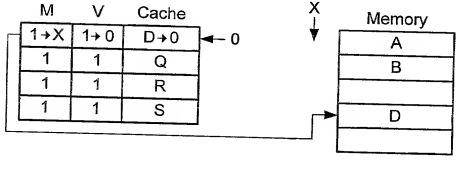

FIG. 15C

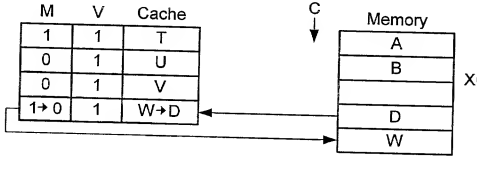

FIG. 15D

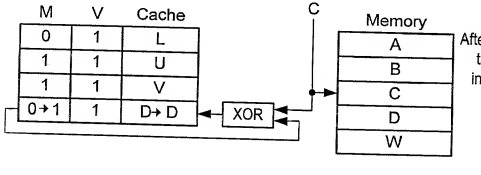

FIG. 15E

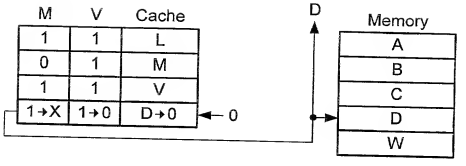

FIG. 15F

Accumulation Operation:
D = A XOR B XOR C

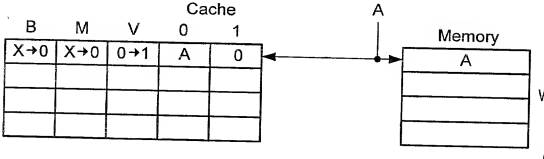

FIG. 16A

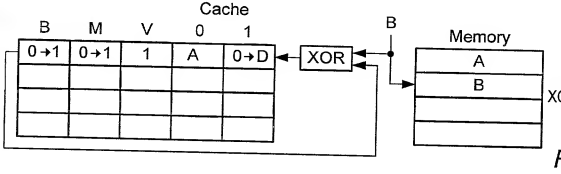

FIG. 16B

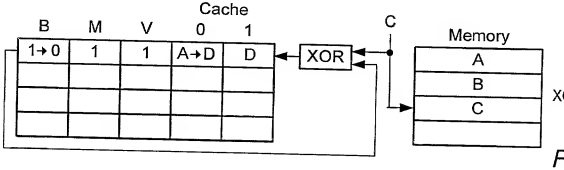

FIG. 16C

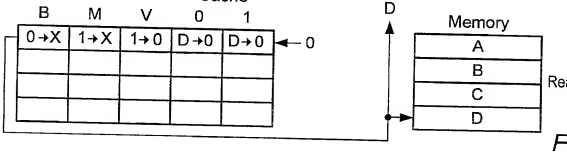

FIG. 16D

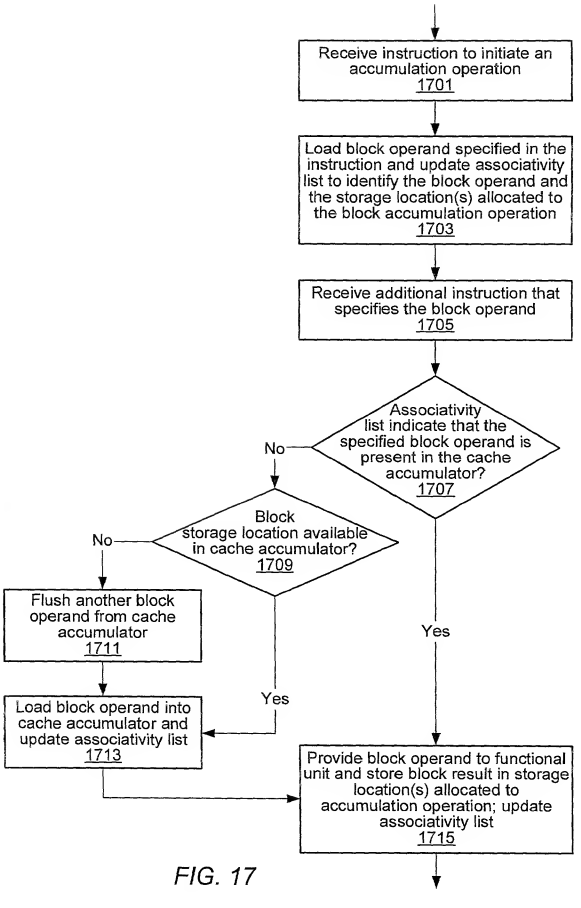
Receive instruction to initiate an accumulation operation
1701
Load block operand specified in the instruction and update associativity list to identify the block operand and the storage location(s) allocated to the block accumulation operation
1703
Receive additional instruction that specifies the block operand
1705
Associativity list indicate that the specified block operand is present in the cache accumulator?
1707
No
Yes
Block storage location available in cache accumulator?
1709
No
Yes
Flush another block operand from cache accumulator
1711
Load block operand into cache accumulator and update associativity list
1713
Provide block operand to functional unit and store block result in storage location(s) allocated to accumulation operation; update associativity list
1715

FIG. 17